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Vol. 12 SEPTEMBER, 1921 No. 6

Mental Survey of Utah Schools

AND

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Adaptation of the Army Beta Tests

BY

GEORGE S. SNODDY
Professor of Psychology in the University of Utah
AND
GEORGE E. HYDE
Superintendent State Mental Hospital
Provo, Utah

FEB. 28th
MDCCCL.

PUBLISHED BY
DEPARTMENT OF PSYCHOLOGY, UNIVERSITY OF UTAH
IN CO-OPERATION WITH
UTAH STATE BOARD OF INSANITY

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OUR OBLIGATIONS TO UTAH SCHOOLS.

The State Board of Insanity and the department of psychology of the University of Utah feel the greatest debt of gratitude to the school people of the state, superintendents, principals and teachers, who have supported this survey with earnest efforts and heartiest good will throughout our work. We are particularly indebted to Supt. W. Karl Hopkins and the Board of Education of the Ogden schools who invited us to begin the state-wide survey in the city of Ogden.

THE PROBLEM.

During the winter months of 1919-20, the Utah State Board of Insanity appealed to the department of psychology in the University of Utah for aid in conducting a state-wide mental survey of the school children of the state, excluding Salt Lake City which maintains its own department of clinical psychology. It was desired to test only the first five grades in the public schools. It was soon found that this work would require the perfection and standardization of a set of group mental tests; which tasks were undertaken by the department of psychology* with the assistance of the State Board of Insanity.

The survey was undertaken with the following ends in view: (1) making a study of the school population with the view of determining those of superior abilities for educational and vocational purposes, (2) locating those who might be doing poor or unsatisfactory work in school because of mental retardation or physical handicap and (3) the perfection and standization of a set of mental tests with such forms and standards for Utah children that the tests could be continued by the school superintendents and principals of the state after the completion of the preliminary survey.

The funds at our disposal, as well as the requirements of the school men of the state who were later to use our norms and standards, made it necessary that the expenses connected with the securing of the tests blanks and with the giving of the tests be given due consideration. It was early decided that it would be necessary for the department of psychology to train competent examiners and send them out over the state prepared to give the tests in a manner characterized by both uniformity and efficiency. The traveling expenses of these examiners, the expenses of printing, clerical help and incidentals, appeared so large that it was impossible for us to consider such excellent group tests as those developed by Otis, Haggerty, Dearborn or the National tests because of the high initial cost of their test blanks.

The Training School of the University of Utah was placed at our disposal for all preliminary study of available tests and for determining methods of procedure. Two hundred children of this school had been previously tested by the Stanford-Binet tests† and were available for checking up on any new tests we might use. The first group test to be tried out was the Myers Mental Measure.

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*The writer of this report (S) is greatly indebted to the following people: To Dr. George E. Hyde of Provo, Utah, for constant help and encouragement in the prosecution of the survey; to Dr. Raymond H. Wheeler of the University of Oregon for valuable information regarding the use of the Beta tests in the army; to A. L. Beeley, Assistant Professor of Psychology in the University of Utah, for constructing the demonstration charts and for much help in developing the instructions formulae; to Miss Fiametta Rhead, Instructor in Psychology, University of Utah, for active supervision of much of the testing in the field; and to many advanced students who acted as examiners and assistants with the clerical work.

†Mental Survey of a Training School—Ione Christensen, Utah Educational Review.

We were forced to discard this test for the two-fold reason that the results with our Training School demonstrated the fact that the correlation with the Stanford-Binet, .50, was too low, and the percentage of "accidents," or failures among those children shown to be normal by the Standford-Binet, and by reference to school work, was found to be too high. We soon discovered that one of the chief difficulties facing a group test was the number of such accidents arising through failure to understand instructions, or through incapacitation of the child because of nervousness or excitement due to the presence of strangers in the class room, or to slow adaptation to a novel situation. This was found to be especially the case with children in the three lowest grades, where ages range from six to nine. We came to appreciate in a more profound way the value of the rapport established between the examiner and child in the Stanford-Binet individual tests.

With these experiences before us we recognized the necessity of employing the play or game element as far as possible and of using adequate demonstration material in the presentation of the tasks. We next considered the Army Alpha tests which, however, were not usable in our state because of their emphasis upon langauge, particularly reading ability, an element which would be sure to bring disaster in our coal and copper mining districts where the percentage of foreign born and foreign language speaking population is large. Our last consideration was the Army Beta tests which, after considerable modification and supplementation, were adopted. These tests may be made to involve the play or constructive element to a desirable degree and the tasks to be done by the children are open to the completest possible chart and verbal demonstration.

One of the most important limitations in the case of the Beta tests was the fact that most of them cannot be given satisfactorily to children below the third grade; this defect was remedied by the introduction of a set of supplementary test in the first two grades. For our purposes, one of the most desirable elements to be found in the Beta tests was their possession of many novel situations which, when carefully approached by proper demonstration, make possible an evalution of the rate of adaptation to a new situation, a datum shown by many experiments in our laboratory to be particularly valuable for vocational purposes. This is especially the case with test I (mazes), test II (block counting), test III (completion), test VII (formboard) of Form O, Group Examination Beta. Test V (number checking) was shown by preliminary experiments to be excellent for detecting poor eye sight and also many psychopathic conditions. Test IV (substitution) was not found to be satisfactory and was modified into an instructions test adapted after test I in Alpha. The blanks for Beta were bought from the Surplus Property Division of the War Department at their published prices, probably less than their original cost.

TWO EXAMINATIONS NECESSARY.

Since all of the tests in Beta could not be given to the children in the first and second grades we found it advisable to divide our tests into two distinct parts, an **elementary** set and an **advanced** set, each containing seven tests.

The **elementary** examination consisted of the following tests: Test I was the Missing Elements (test No. 6 of Beta) which was found to be as satisfactory for the children in the first and second grades as for those in the advanced grades. Test II was an instructions test of our own make adapted after the instructions test in Alpha, using Figs. 1, 2, 3, 4, of test No. 8 of Beta. Test III (Complex Figures) was one of our own construction, employing Figs. 7, 8, 9, 10, 11, 12 of test No. 8 of Beta. The remaining tests of the elementary set were printed upon a separate sheet of yellow paper which could be inserted between the pages of the Beta blank after the examination was completed; the yellow paper, easily distinguishable from the Beta blank, prevented loss, or failure to collect a sheet, at the close of the examination. Test IV (Aesthetic Comparison) employed the six figures used in the test for year five of the Stanford-Binet and year six of the 1911 Binet. Test V (Dot Pointing) was adapted from the same test by Pintner (Journal of Applied Psychology). Test VI (Counting Toes) was taken directly from the same test as used by Miss Lowell (Journal of Applied Psychology). Test VII (Diamond) was taken from year VII of the 1911 Binet.

In the advanced set all of the first seven tests of Beta were used somewhat in the same way as indicated in the army manual except test IV which was modified into an instructions test, as indicated above.

DEMONSTRATION CHARTS.

Demonstration charts were used in the presentation of the tasks to be performed by the children. These charts were, in the main, similar to those used by the Army. In case of the elementary examination we used the diagrams upon the test blanks and blackboard chart demonstrations, as will be seen in the instructions for giving the tests in later paragraphs. Our charts were made by using heavy black crayon on white cards, each 22x28 inches. The drawings were made similar to those used on the Army blackboard cloth charts, but were not so large because of the smaller size of our charts. In test III (latter part of Beta No. 8) of the elementary examinations we used six charts as shown in Fig. 1, each chart containing a figure similar to one in Beta No. 8, and in addition certain crosses and circles to be filled in by the pupil. (See Fig. 1).

In the advanced examination, in test I (Beta 1) we used a chart similar to the one used in the Army but employing only the first diagram. (Fig. 2). The diagrams were made as large as the size of card, 22x28 in., would permit. In test II (Beta 2) we

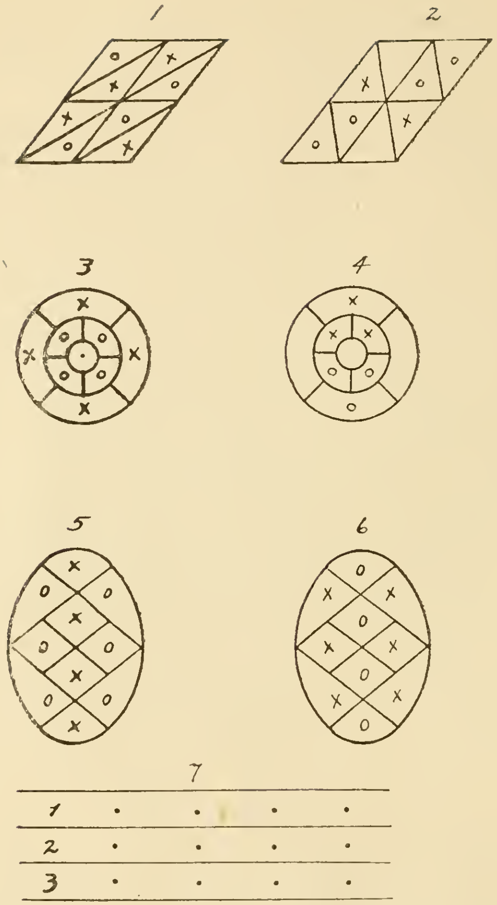

Fig. 1. The first six drawings show the charts used to demonstrate test III (complex figures) in the elementary examination. The bottom drawing shows the top of the sheet placed in the hands of the pupil for test V (dot pointing) in the elementary examination.

used the first two rows of figures as shown in the Army chart; we also used the demonstration solids described in the army manual. In test III (Beta 3), we used no chart (see instructions for giving the test). Test IV (Beta 4) was used as an instructions test and no demonstartion chart was used. Tests V, VI, and VII were demonstrated by using charts practically duplicates of those used in the Army, but employing fewer and smaller figures. (See Fig. 2).

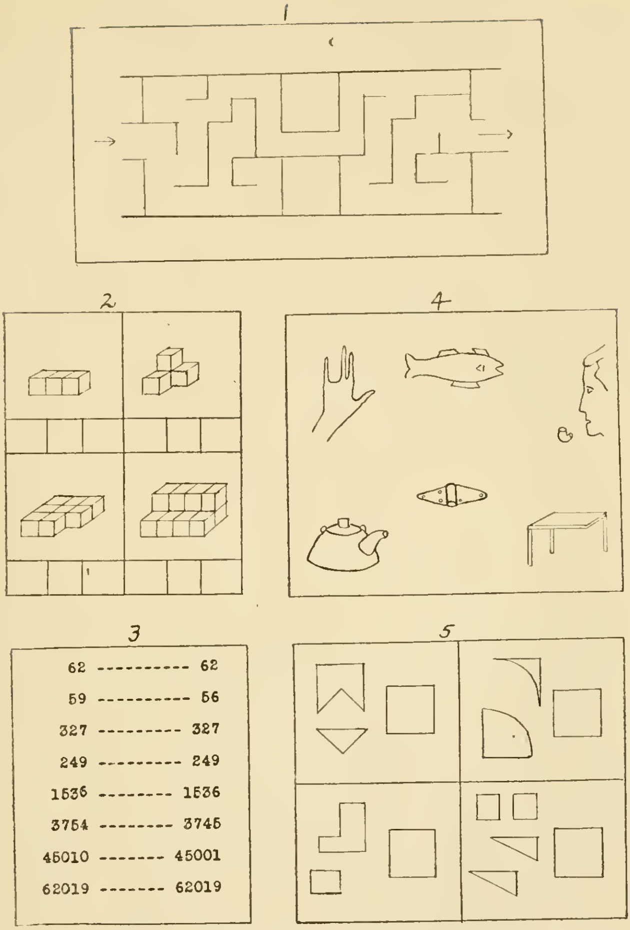

Fig. 2. Showing charts used to demonstrate tests I, II, V, VI and VII in the advanced examination.

INSTRUCTIONS.

In the matter of presenting our demonstration material we tried out both the pantomime principle developed by the Army and the instructions formulae in simple English, illustrated by the use of the chart. We concluded that the latter method was best suited to our needs. While it is true that some of our children were handicapped in the matter of English, yet, in the main, this limitation applied only to the written language, as in Alpha, where emphasis is placed upon reading ability. It was not thought that many children in our public schools would fail to understand simple English, especially when the spoken formulae were supplemented by reference to drawings or to illustrations on the blackboard; and our final results abundantly confirmed this conclusion: in fact, only a very small percentage of children have been found in our survey of fifteen thousand who fell in the failure group because of failure to understand the instructions through foreign handicap. Our examiners were trained in the rigid use of the instructions formulae and the demonstration charts. They learned the formulae verbatim and gave them in a clear conversational tone without use of notes, except in the case of test IV of the advanced set, and test II of the elementary set, where the possibility of error was too great to depend upon memory. The instructions formulae, use of charts, time and scoring of each test are shown in the following paragraphs.

INSTRUCTIONS FOR ADVANCED EXAMINATION.

Grades 3 to 5, Inclusive

Test I (Maze)

Demonstration Material: Chart 1, Fig. 2.

Now here are some paths (pointing to chart) and here is an arrow (pointing to one on left) and there is an arrow. Now if we choose the right path we can go from this arrow (left) to this arrow without coming back and without crossing a line; coming back and crossing lines are mistakes. (E places tip of pointer at left hand arrow and moves to the right to position No. I; then stops with puzzled look and says—). Now let us stop here and see which way we must go (holding position with pointer); if I make a line up here I couldn't get out and would have to come back and that would be a mistake, so I must follow this path (moving pointer along to position No. 2, where he stops). Now let us see which way to go; if I go this way I will have to come back and that is a mistake, so I must take this path (tracing with pointer to position No. 3). Now how shall I go? Up, or this way? (Wait for answer). Yes, that is right (tracing toward arrow), there we are.

Now here (pointing to test I of Beta) are five things like the one we did. Take your pencils and when I say ready, but not before, draw a line in each one of these from the arrow on this (left) side to the arrow on this (right) side without crossing any lines and without coming back. First do this one, then this one, then this one, etc. Do the best you can and don't waste any time. Go.

Time: Two minutes.

Score: Each maze counted four points and credit was given for a half is correct.

TEST II (Counting Blocks).

Demonstration Material: Chart 2, Fig. 2; and block models.

Here are some pictures of blocks (pointing to chart) built up in different ways. Now, how many blocks are there here (pointing to No. 1 and waiting for answer)? And how many are here (pointing to No. 2)? (E refers to model No. 1 and taking off top block from model says,—) You see this one hides one underneath so there are four blocks here. Now in this group there are some blocks hidden also, see (pointing to model 2, and turning it around).

Now turn to page 2 in your booklet and when I say go, but not before, count the blocks in each place (pointing) and put the numbers in the little squares underneath. Don't forget to count the blocks that are covered up. Start here and go this way (indicating the left to right order for each row). Do the best you can and don't waste any time. Go as far as you can. Go.

Time: Two minutes.

Score: Two points on each.

TEST III (Completion).

Demonstration material: None.

Now listen, I am going to give you a problem. Suppose we had a row of bricks running from there up to here (pointing), and then a boy came along and made the row longer by putting some more bricks right along, one by one, just like the other bricks in the rows. We could all do that, couldn't we? Well, now suppose we have a row of things but they are not all bricks. We look closely and find there is first a brick and then a stone, next a brick and then a stone, next a brick and then another stone. Now suppose you had to finish out the row and the last thing was a brick what would the next one be? After that, what would the next be? Now let us suppose there was first a stone and then two bricks, then another stone and two bricks. The end of the row is two bricks, what would the next one be?

Turn to page 3 in your booklet. See the long rows of marks with the blank spaces at the end. Now when I say go, but not before, I want you to fill out the rows with your pencil just like they have been started. Remember about the bricks and stones; you had to look at the row and see how it was going before you could fill it out. These marks are like bricks and stones and you must look to see what the row is before you fill it out. Start up here, and go down this way (pointing). Do as many as you can. Go.

Time: Three minutes.

Scoring: Two points on each line correctly done.

TEST IV. (Instructions—Beta 4, modified)

Demonstration material: None.

Turn to page 4 of your booklet. Look at the rows of numbers at 1, 2, 3 down to the bottom of the page. Listen carefully to what I say. I am going to tell you to do something with each row and when I say go, you will take your pencils and do what I tell you to do. Do not make a mark until I tell you to go.

Look at the row of figures at No. 1 Listen carefully. Put a cross under every 4, 1 and 3. Go.

Look at No. 2. Put a cross under every 2 that is beside a nine and under every 3 that is beside an 8. Go.

Look at No. 3. Put a cross under every 7 that is between a 4 and 3. Go.

Look at No. 4. Put a cross under every 4 that is between a 7 and 6, and every 5 beside a 9. Go.

Look at No. 5. Put a cross under every 4 that is beside a 6, every 2 beside a 4, every 3 beside an 8. Go.

Look at No. 6. Put a cross under every 1 between a 4 and 8, every 5 beside a 7, and every number more than 8. Go.

Score: Four points on each line correctly done.

TEST V. (Number Checking).

Demonstration Material: Chart 3, Fig. 2.

Now here are two columns of figures, (pointing to chart). You see these (pointing to 62—62); they are alike. (Demonstrate in similiar fashion up to and including 3745).

Now turn to page 5 of your booklet. Look at the two rows on the left and the two on the right. When I say go, but not before, put a figure one on the dotted line when the numbers are alike; and a cross when the numbers are not alike. (Turn to chart and point to first pair). What would you put here? (Wait for correct answer). Yes. What would you put here? (Wait for correct answer and indicate with pointer the proper sign). What here? (Illustrate in case of each one, holding always for correct answers). Now on your papers put on the proper marks; begin up here and go down this row, then up here and down this row. See how many you can do correctly before I call time. Go.

Time: Four minutes.

Score: The number right minus the number wrong.

TEST VI (Missing Elements).

Demonstration material: Chart 4, Fig. 2.

(E points to chart). In each one of these pictures there is something missing, something gone. What is missing in this picture? (Point to No. 1 of chart, then to No. 2, etc. Wait for correct answer and indicate the missing part with a movement of pointer).

Now turn to page 6 of your booklet. In each one of these pictures there is something missing. When I say go, but not before, take your pencils and put in the missing part. It doesn't matter how well you draw it just so we can tell what you mean. Start with No. 1 and do as many as you can. Go.

Time: 2 minutes.

Score: Two points on each correctly done. (See Army manual for instructions).

TEST VII (Modified Formboard).

Demonstration material: Chart 5, Fig. 2; cardboard cut-outs.

(Demonstrating by means of the chart and cardboard cut-outs, E says) These two figures have been cut from a square just like this (pointing). Now when I fit them together, you see they form a perfect square. (Here E superimposes the two pieces upon square in chart). When I place these two pieces together, they also make a perfect square. Now (pointing to chart) if I placed these four pieces together properly they would make a square, too.

Now turn to page 7. When I say go, but not before, take your pencils and make lines in each square showing how you would cut it up into pieces just like those on the left of the square. First do 1, then 2, and so on. Do as many as you can before I call time. Go.

Time: Three minutes.

Score: Two on each.

INSTRUCTIONS FOR ELEMENTARY EXAMINATION

Grades 1 and 2.

TEST I (Missing Elements—Beta VI)

Demonstration material: Chart 4, Fig. 2.

(E points to chart). In each one of these pictures there is something missing, something gone. What is missing in this picture? (Point to No. 1 of chart, then to No. 2 etc. Wait for correct answer and indicate the missing part with a movement of pointer).

Now turn to page 6 of your booklet. (Show the children how to find the page). In each one of these pictures there is something missing. When I say go, but not before, take your pencils and put in the missing parts. It doesn't matter how well you draw it, just so we can tell what you mean. Start up here with No. 1, then do these (pointing to 2, 3, 4) then the next row, then the next row. Do as many as you can. Go.

Time: Three minutes.

Score: Two points on each.

Test II (Instructions).

Demonstration material: none.

(First show how to make X and O). Look at these squares (pointing to Figs. 1, 2, and 3, Beta VIII). In the first figure there are two squares, one above and one below; in the second figure there are two squares above and one below; in the third figure there are two rows of three squares each, one row at the top and one at the bottom:

Now look at the first figure, and listen carefully to what I say. Take your pencils and when I say go, but not before, put a **cross** in the square at the top and a **circle** in the square below. Go.

Now look at the second figure. Put a **circle** in each square at the top and a **cross** in the square below. Go.

Now look at the next figure (3) with the two rows of squares, one row here and one row here (pointing). There are three squares in each row, this is the first one, and this is the second one, and this is the third one. Now when I say go, but not before, put a **cross** in the first square of the top row, and a **circle** in the third square of the bottom row. Go.

Now look at the next figure (4) where there are three rows (pointing) and three squares in each row. Now listen very carefully, put a **circle** in the first square of the bottom row and a **cross** in the second square of the top row. Go.

Time: Allow children to complete.

Score: Five points each.

Test III (Complex Figures).

Demonstration material: Beta VIII and charts, Fig. 1.

Now look at the figure down under the 7 (pointing to Fig. 7, Beta VIII). Look at the figure carefully. Now I am going to show you a large figure just like that except the one I shall show you will have some little crosses and circles in it, and when I say go you are to take your pencils and put a cross in your figure wherever you see a cross in the big figure and a circle where you see a circle. I am going to let you look at the big figure so you can copy the crosses and circles in the right places. Be careful and work fast. Now. (Expose Chart 1, Fig. 1), Go. Allow children to complete.

Now look at the next figure (Fig. 8). This time I am going to show you a big figure just like that one with some crosses and circles in it; but this time I am going to let you have one big look and then I will cover up the card, you will have to know where all the circles and crosses are when I say go, because if you look back the card will be covered up. Now for the big look; get your pencils ready but do not write until I say go. Look. (Expose chart 2, Fig. 1, for seven seconds). Go. (Cover up chart).

Now look at the next figure under the 9, down here (pointing).

This time I am going to show you a large figure like that with circles and crosses in it and this time you will have just one big look and then I will cover up the card. Get ready. Look. (Expose chart 3, Fig. 1 for seven seconds). Go.

Now I am going to show you another one like the one you just copied and there are some crosses and circles in it. This time you will have just one big look again, and you will have to remember just where the crosses and circles are. Get your pencils ready but do not write until I say go. Look. (Expose chart 4, Fig. 1, for seven seconds). Go.

Same as above for 11 and 12.

Time: Allow children to complete.

Score: One-half of one point for each character correctly placed; total number of points is 24.

TEST IV (Aesthetic Comparison).

Demonstration material: None, except Binet pictures on test blank.

Now look at this yellow sheet (pointing to extra sheet), you see the picture of these heads, don't you? Some of these pictures are pretty and some are not. First look at these two pictures, then these two pictures, and then these two pictures. Take your pencils; look at the two top pictures; now put a cross under the prettier one. Go. Now look at the next two pictures and put a cross under the priettier one. Go. Now look at the next two and put a cross under the prettier one. Go.

Time: Allow children to complete.

Score: Two each.

Test V (Dot Pointing).

(Examiner makes four dots in a line upon the blackboard about eight inches apart, also four dots about three inches apart and low enough for children to reach. The first line is used for pointing, and the dots of the second line are to be connected up after the first pointing as a demonstration of method of connecting dots).

Here are four dots on the blackboard. I am going to point first to one dot and then another and I want to see if you can do what I do. (Point to dots 1, 2, 3, 4 in order). Can you do that? (Take chalk and connect up the sample). (Point to 1, 2, 3, 4, 2; do not lift pointer from blackboard and be careful to go above the imaginary line connecting dots when moving to the right and go below this line when moving to left). How did I go that time? Yes I went up this way then this way (connecting up dots in sample). (Point to 1, 3, 4, 2 and 1, 3, 2, 4 and have children come to the blackboard and connect up the points). Now look at these dots on your yellow papers (pointing). I am going to point to the dots on the blackboard and after the first time I want you to take your pencils and make the marks from one dot to the other upon your paper just like I point to them. Use the first line of dots for the first time. Go just like I go. Do not mark until I say go. (Examiner then points to the following lines, getting attention of each child before pointing, and saying go at end of each line).

1. 1 2 3 4 1
2. 1 4 3 2
3. 1 4 2 3
4. 1 4 3 1
5. 1 2 4 3
6. 1 3 2 4
7. 1 4 3 2 1

Time: Allow children to complete; point to dots about one per second.

Score: Five for each line correctly done.

TEST VI (Counting Toes).

Demonstration material: None.

I am going to ask you a question, I want you to put up your hand if you know, but I don't want anybody to say a word. Who knows how many toes he has on his left foot? Right foot? Both feet? Now look at your yellow paper where the three short lines are, with the 1, 2, 3, See? (Point). You know how to make little marks like this, (/ / / / /) don't you? (Illustrate on the board). Now I want you to put a little mark on the first line here for every toe on your left foot. Go. (Wait until this is done). Now put a mark on the second line for every toe on your right foot. Go. Now put a little mark on the third line for every toe on both feet. Go.

Time: Allow children to complete.

Score: Two each; total of six points for test.

TEST VII (Diamond).

Demonstration material: None, except diamond on test blank.

You see the diamond on your yellow paper, don't you? (Point). I want you to take your pencils and draw one just like that. Draw yours on the right side of the one on the paper. Go. (After children have finished, say—) Well, this time draw a better one, one just like the printed one. Go.

Time: Allow time for completion.

Score: Ten points if one drawing is satisfactory.

EXAMINERS.

At the outset we trained twenty advanced students to do the examining. Most of these students were majoring in psychology and all were seniors or graduate students; many had had experience as teachers. These examiners were trained to work in pairs; one was to direct the examination and give the demonstrations while the other acted as monitor in the class room, distributing the test blanks, encouraging backward children, maintaining discipline and keeping time for the tests. During the day the examiners would alternate in the position of examiner and monitor so as to avoid fatigue on the part of the examiner whose task is difficult.

Upon entering a schoolroom the examiner in charge of the examination would ask the teacher to take no part in the examination and to tell the pupils that she was going to have them do some easy things for her on some papers that were being distributed. The demonstration cards were set up on an easel in the front of the room and the examiner demonstrated what was to be done by using a blackboard pointer. In the case of children in the first and second grades, small printed stickers were handed to the teacher who filled in the name of the child, year and month of birth. These were dropped upon the appropiate desks and were stuck to the examination blank at the close of the examination. In the case of the higher grades each child wrote his own name, year and month of birth in the appropiate places in the Beta blank. The time required for giving the examination in the first and second grades was forty minutes, which was broken by a five minute rest at the close of the fourth test; during the recess the children were given a calisthenic drill with the windows of the room thrown open. The time for the advanced examination was thirty minutes.

SCORING.

All of the test blanks were brought to the University where they were graded by trained clerical help. The score to be assigned to each test was determined in part by reference to the trial test in the Training School and in part by a preliminary survey of data from the field work.

It was found in this preliminary study that in the group examination of elementary children one of the most necessary things was to prevent accidents on the part of normal children through failure to perform normally in the examination by reason of excitement or slow adaptation to a new situation. One of our aims, then, was to give this examination the greatest possible amount of stability; and one of the best ways to do this was to give the stablest or most invariably good tests the heaviest weight, provided, of course, the tests carried sufficient discriminative capacity. Test 3, complex figures, proved to be precisely the test best suited for this purpose. When each character correctly placed was given a score

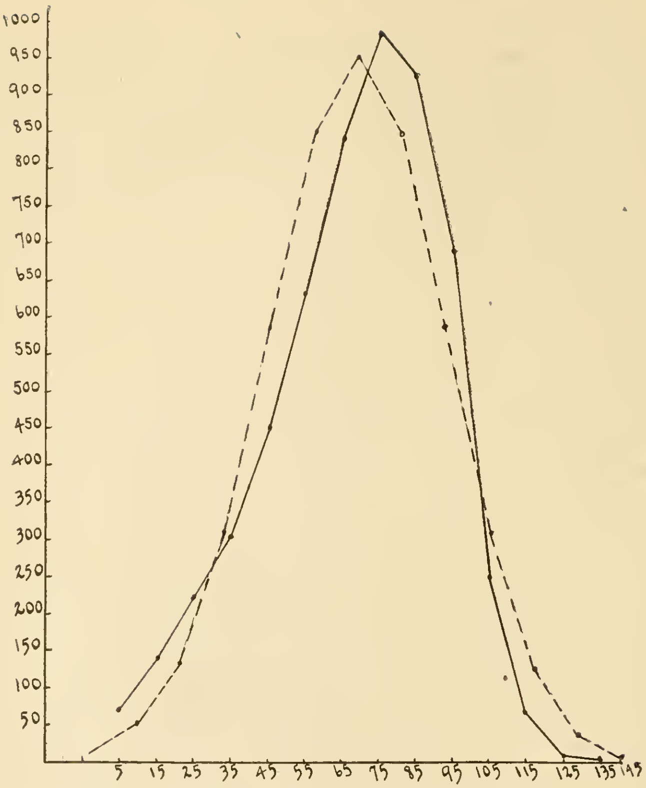

Fig. 3. Frequency polygon (solid line) showing the distribution of 5600 children in the elementary examination. The dashed line shows the normal probability distribution superposed upon the actual. Stations in the actual distribution are erected at the mid-points of the class intervals. The scale at left indicates frequencies, base line, scores in points.

of one-half of one point, this test would carry a total of twenty-four points, and the average first grade child was found to earn about fifteen points and the average second grade child about twenty points; thus the test possessed a large amount of discriminative capacity and, according to this plan of scoring, a heavy score. It is worth noting that very few children fail to make some score in the test when scored in this way, yet, when the test is scored by assigning a value, say two points, to each diagram correctly done, the discriminative capacity of the test is increased enormously, but the percentage failing to make any score in the test is large and the test thus loses its stability.* Accordingly, a certain amount of discriminative capacity was sacrificed in order to give greater stability to the test. As soon as it was decided to allow a possible total of twenty-four points for this test the work of scoring the other tests in the series was simply a matter of assigning such scores as would be easily computed and give each test a significant place in the total score of the average pupil and at the same time give average distribution results for large groups of children when the total scores are considered.

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*A separate laboratory study on this test is to be published soon in which these elements were brought out in greater detail. The writer is firmly convinced that too little attention is being paid to the stability factor in group tests.

THE EXTENT OF THE SURVEY.

The survey covered the first five grades in many Utah schools, including first, second and third class cities, rural communities and every variety of population the state possesses. All typical populations were sampled in rough proportion to the ratio these populations bear to the population of the state as a whole. The following typical communities were examined: The entire city of Ogden, a population largely industrial; the cities of Logan, Brigham City, Provo, American Fork, Heber, Nephi, Manti, and Tooele, with populations largely agricultural; the copper, coal and silver mining districts of Bingham, Price, Castle Gate, and Park City; the smelting and ore reduction communities of Garfield, Murray and Midvale; and many small town and rural communities in Cache, Box Elder, Davis, Iron, Juab, San Pete, Sevier, Summit, Utah, Wasatch, and Washington counties. The number of children considered in determining our standards was over 13,000; the total number of children tested exceeded 15,000.

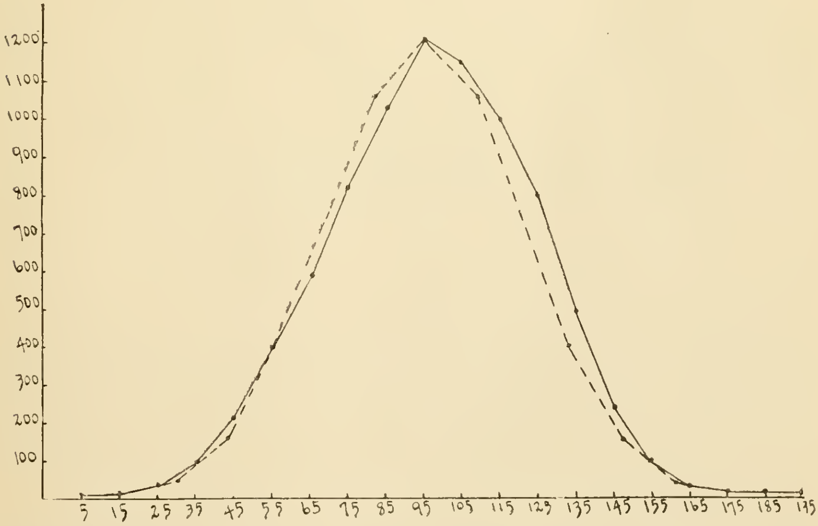

Fig. 4. Frequency polygon (solid line) showing the distribution of 8,000 children in the advanced examination. The dashed line represents the normal probability distribution superposed upon the actual. Stations in the actual distribution are erected at the mid-points of the class intervals. Scale at left refers to frequencies, base line, scores in points.

QUANTITATIVE RESULTS.

The frequency distributions of the children in both the elementary and advanced examinations are shown in Table 1. (See last page.) It will be observed that at every age level the distributions closely approximate those of the normal probability type. The largest deviations from this are seen in the case of the six and eight year levels in the elementary examination. The curve for the six years olds is skewed slightly to the left, that for the eight year olds is slightly to the right, while the curve for the seven years olds is quite symmetrical. This state of affairs seems unavoidable when we consder the very rapid mental growth at these ages and the secondary, but very important, fact that many of the most satisfactory tests for these ages, such as aesthetic comparison, drawing diamonds, etc., are of the "all or none," not "point-scale," variety. Our complex figures test (see section on elementary examination) was devised expressly to offset some of the effect of the all-or-none scores. It is obvious that these all-or-none tests throw all their weight at certain ages, an item which does not lend itself readily to group testing, where total scores are used only in the point-scale form. Our effort would probably have led to complete success had we been able to include in our complex figures test a few figures of greater difficulty than those on the Beta blank.

Figures 3 and 4 show the frequency polygons for the entire elementary and advanced examinations, respectively.

METHOD OF MARKING PUPILS.

If figures 3 and 4 are examined it will be observed that in both cases average distribution results are clearly indicated. If the base line of each figure is laid off in segments representing the standard deviation (See Table 1) it will be observed that the frequencies are divided into five parts. These parts seem to approximate somewhat closely to the percentage distributions of 5-20-50-20-5, there being a noticeably greater piling up of frequencies in the center than is the case with the normal probabilities as computed from the binomial theorem, which Rugg divides roughly into the percentages of 7-24-38-24-7 when the base line is considered to be 5 times the standard deviation in length, i. e., 2½ sigma on either side of the mean.

Since it was felt that a fivefold distribution of our measures would classify the children satisfactorily and that the division into 5-20-50-20-5, percents would fit our frequencies as well as any, this method of classification was chosen. Another non-statistical matter favoring this classification was the fact that the one chosen is in use in many schools of the state and thus could be presented more readily to schoolmen untrained in statistical method.

Letter marks, A, B, C, D, E, were assigned to the various classes, with A indicating the high five percent. Since all marks were to be returned to the schoolmen concerned, it was felt that letter marks, A. B, etc., would lead to less unfavorable comparison than would be the case if numerical scores had been assigned.

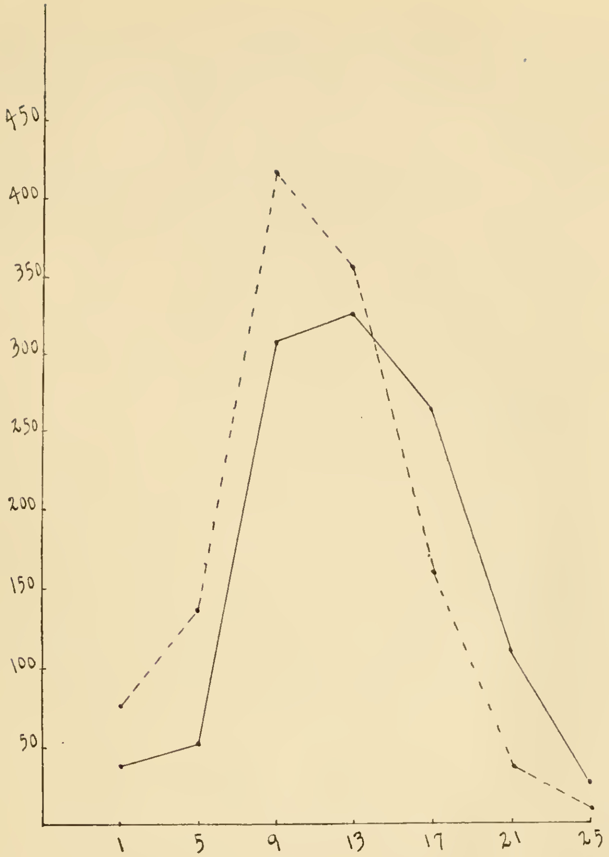

Fig. 5. Showing the frequency folygons for the boys (solid line) and girls (dashed line) as determined by the scores in test II (block counting) of the advanced examination. Ordinates are erected at the mid-points of the class intervals.

CORRELATION WITH OTHER TESTS.*

To determine the correlation between the scores assigned by our tests and those of other reliable scales, careful studies were made comparing our elementary scores with those of the Stanford-Binet tests and our advanced scores with those of the National tests, Form A. In the case of the elementary examination and the Stanford-Binet, both tests were given to one hundred superior children in the Training School of the University of Utah. The correlation, involving straight-line relationship and computed according to the

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*The material of this section is based largely upon the statistical and testing work of Hattie N. Smith and Ione Christensen, graduate students, and Elaine Kinder and Elizabeth N. Packard, advanced students, in the Department of Psychology, University of Utah.

Pearson Products-Moment method, was .71, plus or minus .0345. We are convinced that this correlation would have been higher with children conforming more closely to average distribution since our scale is not so satisfactory in the higher mental ages of the elementary group.

In the case of our advanced examination and the National scale, the tests were given to over four hundred children in the Whittier school of Salt Lake City. The correlation, involving perfect linear relationship, and computed according to the Pearson Products-Moment formula, was .95 plus or minus .0033. This amazingly high correlation between the two scales was observed early in our work which led us to include the four hundred unselected cases in the third, fourth and fifth grades of the Whittier school. It should be said further that after eliminating a few cases, some nervous and excitable children who fell low in the Utah-Beta and some with language difficulty who fell low in the National, the correlation is very nearly perfect. The fact that our test throws into the failing group many nervous and neurotic children will be discussed in our section, an "Analysis of the Low-Five Percent." It may also be observed that the results in the Whittier school demonstrate clearly that it is possible to build a group test upon pure (that is, untrained) mental elements which will give results strictly comparable with those of a test depending, to some extent at least, upon school training,—a fact of great significance when it is observed that we cannot always presume a uniform amount of school training in state-wide surveys.

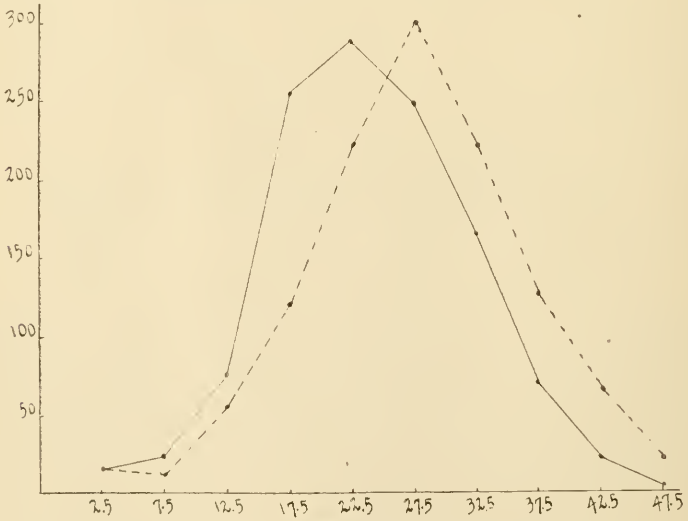

Fig. 6. Showing the frequency polygons for the boys (solid line) and girls (dashed line) as determined by the scores in test V (number checking) of the advanced examination. Ordinates are erected at the mid-points of the class intervals.

SEX DIFFERENCES.*

The character of the tests in our advanced examination is such as to make them suitable in the highest degree for a study of sex differences. The mental elements required in the tests vary consideraby from test to test and the tests are scored in such fashion as to facilitate comparison of the work of the sexes. Observation of the work of the sexes in the field led us to suspect that the sex differences would be unusually marked.

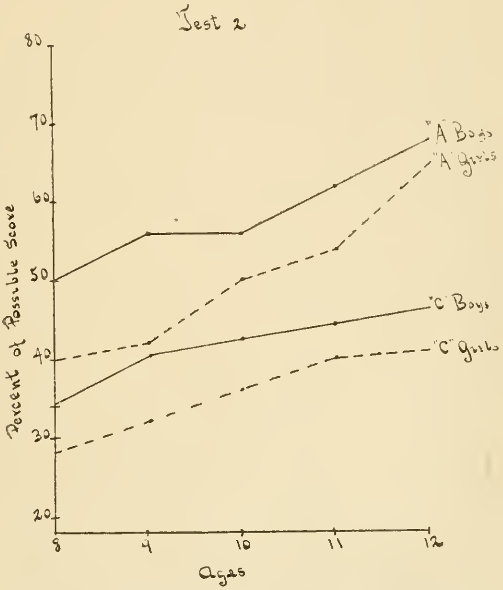

Fig. 7. Showing the superior standing of superior and average boys of all age levels over the girls of the same age levels in test II (block counting) of the advanced examination. The boys of the A, B, C, D, and E groups are superior to the girls of these groups at all age levels.

When the entire body of data for our advanced examination was divided into the two sex groups, the sex differences were found to be so large as to be almost unbelievable. In tests 1 (mazes) and II (block-counting) the boys of all age groups were much superior to the girls. In tests III (completing lines) and V (comparing numbers) the girls were much superior to the boys. In tests IV, VI, and VII, and in the total scores for each age group, sex differences are slight and variable from age to age.

In the case of the ten year olds taking test II we have 1161 boys and 1160 girls. The standard deviation of the boys was 4.8.

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*The statistical material of this section is drawn from a study of sex differences made by A. L. Winsor, graduate student in the department of psychology, University of Utah.

and that of the girls was 4.08. The means of the boys was 13.12, and that of the girls, 10.68. The difference between these two means, 2.44, is about 20 times the probable error of their difference; which proves well beyond statistical certainty that the sex differences are real and not due to errors of sampling.

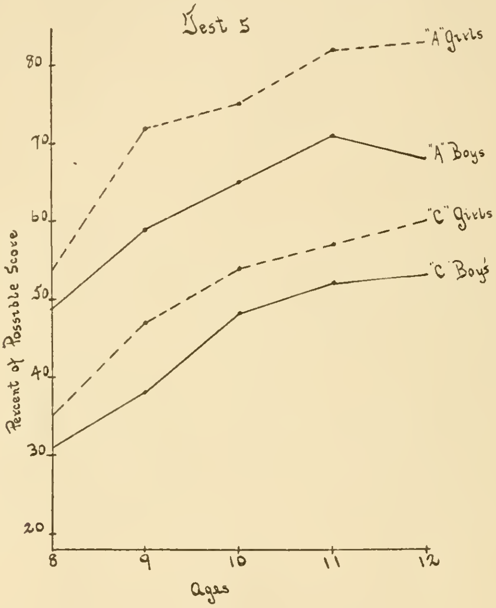

Fig. 8. Showing the superior standing of superior and average girls of all ages over the boys of the same age levels in test V (number checking) of the advanced examination. The girls of the A, B, C, D and E groups are superior to the boys of these groups at all age levels.

In the case of the ten year olds in test V, 1161 boys and 1160 girls, the standard deviation of the boys is 8.15, while that of the girls is 8.7. The mean of the boys is 24.42, and of the girls, 27.72. The difference between these two means, 3.35, is 22 times the probable error of their difference. Thus in test II the girls are 80% as efficient as the boys, while in test III the boys are 88% as efficient as the girls. These differences hold for the A, B, C and D groups in both tests. See Fig. 7 for the average scores of the A, C groups at all age levels.

ANALYSIS OF THE LOW FIVE PERCENT

After the papers had been scored and the children classified in age groups, the names of the low five percent and high five percent of each age group were returned to the teachers for comment. The teachers through cooperation with their principles and superintendents supplied, in the case of the low five percent, the following information for each child: (1) number of years child had attended school, (2) character of work child was doing in school, i. e., of passing grade or not, (3) classification of child as to following mental traits, (a) normal, (b) nervous or excitable, (c) dull or slow, (d) subnomal, (e) feebleminded. It was felt that this five percent group would contain all of the children properly classifiable as subnormal and also allow for "accidents", in particular those due to language difficulties which might handicap a normal foreign child and bring him down into the failing group, as well as those who, otherwise normal, might fail through excitement or nervousness. Out of a list of 684 names sent to the schools very accurate and carefully considered reports were received for 648, a showing significant of the support the schools of the state gave the mental survey.

The schools classified these 648 children who fell in the "E" or failing group in the following way:

(a) 158 (24.4% of the failing group) were considered mentally normal. Some of these had language difficulties, some were deaf, a few were blind or nearly so; fifty per cent of them had physical defects, chiefly bad tonsils or poor eyes.

(b) 129 (20% of the failing group) were considered able to do satisfactory school work but were classed as nervous or excitable, requiring special care.

(c) 250 (38.4% of the failing group) were considered dull or slow. 117 of them (18% of the group) were considered able to do satisfactory school work under the best conditions and were not seriously retarded; 135 (20% of the failing group) were seriously retarded and were unable to do satisfactory school work.

(d) 97 (14.9% of the failing group) were considered subnormal and unable to do satisfactory school work.

(e) 14 (2.16% of the failing group) were classed as definitely feebleminded.

When we consider the statistics above in the case of the dull, subnormal and feebleminded classes, we observe that, if we eliminate the 117 of the dull group indicated as able to do the work of the schools under the best conditions, we have a total of 244 (37% of the failing group), who not only failed in our examination but also are failing to do the work of the schools through dullness, subnormality or feeblemindedness. The writer believes that these criteria for subnormality are the best obtainable in group surveys; and, since dullness grades over into subnormality by scarcely perceptible steps, it is felt that the criterion of successful school work may operate to make the dividing line between dullness and subnormality fairly clear and distinct.

[illegible]

If we have 37% of our low five per cent group classed as subnormal and there should be no cases of subnormality above our failing group, and the writer cannot conceive of such, then subnormality in the first five grades of Utah schools is limited to 1.85% of the population of these grades. If the children in our failing class are assigned to grades we find 44% of them in the first and second grades, 33% in the third grade, 14% in the fourth grade, and 8% in the fifth grade. If this rate of decrease is maintained, and there is every reason to suppose that this is the case, then the number of subnormals above the fifth grade is negligible. Reasoning thus and considering the population of the first five grades as 60% of the total school population of the state (this was the exact ratio at the time of the survey), then we may reasonably place subnormality in the total school population of the state at 1.11% or roughly 1 1/10%.

The Nervous or Excitable Child.

Another matter in the report from the schools of extreme interest is the nervous or excitable class who constitute 20% of the entire failing group. These children were able to do the work of the schools probably through the close rapport established between the teacher and the child, and also through the fact that, as extensive studies in our own laboratory have shown, nervousness and excitability have their chief effect upon the quick or short-time adaptability of the subject. Thus it is obvious that these children would be thrown into the failing class by a group test which emphasizes the short-time adaptabilities, while at the same time they may be able to do satisfactory school work, many of them very superior work; and very probably most of them would have made normal or even superior scores in individual tests where the emphasis upon initial adaptability is less, and the stable, experiential elements from the childs life assume a large part in the examination. Our study of the National group tests (see this section) seems to completely confirm this view. Our advanced examination and the National correlate very highly, .95, yet a small group fail in our test who pass in the National, which weights experiential factors considerably; all of the children of this group are of the nervous or excitable type.

A careful study of the returns from the schools reveals the fact that these nervous or excitable children are distributed equally throughout the first five grades; this would seem to indicate that, since 20% of the failing group are in this class, 1% of the first five grades, or 1% of the entire school population may belong to such a class. If this be the case, then the number of subnormals and the number of nervous and excitable children are almost equal.*

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*The writer does not want to be misunderstood in the matter of the nervous or excitable child. In no sense is it believed that he is peculiar to Utah; rather, it seems that ours is one of the first group tests to isolate this child from the masses for purposes of special study.

SIGNIFICANCE OF PARTICULAR TESTS.*

Not only do our tests show significant sex differences but many of them are of extreme interest for other reasons. Two tests, III (complex figures) of the elementary examination and V (comparing numbers) of the advanced examination show very high correlation with the judgment of the teachers, i. e., almost every child ranked low by the teachers failed in one of these tests. Test IV (instructions) and VII (modified form-board), both in the advanced examination, give good results in this particular, also. Test IV of the advanced examination and test II of the elementary, both instructions tests, demonstrate marked ability in selecting out the nervous or excitable child. In nearly every case where a child did fairly well on other tests but poorly on either of these tests, the schools classed the child as nervous or excitable.

Since we returned to the schools the names of the high five percent, as well as the low five percent, we were able to study the correlation between the judgment of the teachers and the finding of the examination in the case of the superior child. In this instance the tests which show the very highest correlation are V and VII of the advanced and V (dot pointing) of the elementary examination. One test, Beta No. 6, the missing elements test, which was used in both examinations, showed some correlation with judgment of teachers in the elementary, but none at all in the advanced, examination.

The one outstanding point in this study is the fact that teachers' judgments and the ratings of the examinations agree very much more closely in the case of the low five percent than in the case of the high five percent. This is very probably due to the fact, pointed out by Terman and Pintner, that much more than the innate capacity revealed in tests is often involved in the doing of superior school work. It is probably for this reason that teachers do not always recognize their pupils of superior mental capacity.

One thing can be said of most of our tests,, particularly those demonstrated with charts, and this is the fact that the tests have an unusual degree of interest for the pupils, a trait not found in most group tests we have used. Teachers were especially pleased with the conduct and nature of the examinations, a point of the greatest value in conducting state-wide group surveys. At no time did pupils or parents object to our examinations, and but three teachers in over five hundred objected to having their children given the mental tests.

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*The material of this section is drawn very largely from a study by J. R. Griffiths, a graduate student in the department of psychology, University of Utah.

	ELEMENTARY EXAMINATION					ADVANCED EXAMINATION					
Ages—	6	7	8	9	Total	8	9	10	11	12	Total
Scores:											
0- 9	54	12	2	2	70	0	2	1	2	2	7
10- 19	102	25	3	3	133	1	5	2	2	1	11
20- 29	148	50	19	4	221	13	14	5	2	2	36
30- 39	184	89	21	7	301	31	33	14	6	5	89
40- 48	229	195	64	11	499	94	52	32	14	12	204
50- 59	252	248	95	35	630	132	120	69	24	23	368
60- 69	232	364	180	64	840	180	191	130	60	20	581
70- 79	198	442	274	70	984	208	291	184	82	54	819
80- 89	134	361	301	129	925	214	355	281	103	79	1032
90- 99	66	256	236	128	686	129	359	364	216	137	1205
100-109	17	88	102	47	254	109	290	380	213	148	1140
110-119	2	19	27	20	68	42	187	354	231	163	977
120-129		1	6	2	9	18	102	267	235	167	789
130-139		1			1	6	52	165	140	103	466
140-149						0	24	56	76	75	231
150-159						1	6	21	32	31	91
160-169							1	12	9	11	33
170-179								2	3	1	6
180-189										0	0
190-199										2	2
Total	1618	2151	1330	522	5621	1178	2084	2339	1450	1036	8087
Percentiles 5	12	32	44	48		40	49	58	63	65	
10	20	44	53	57		48	59	68	74	78	
20	30	53	63	66		57	70	81	89	91	
25	35	56	67	70		61	73	84	92	94	
30	39	62	71	73		64	77	89	96	98	
40	46	67	75	81		71	83	96	104	105	
50	52	71	80	85		76	89	101	110	112	
60	60	76	84	89		82	95	108	116	118	
70	66	81	89	92		87	101	114	122	124	
75	70	84	91	94		90	103	117	125	126	
80	75	88	93	96		94	107	118	128	131	
90	84	94	100	104		102	118	131	137	140	
95	89	100	106	109		110	126	137	145	147	
100	118	132	129	129		152	163	178	174	194	
Standard Dev.	23.4	20.7	19	19.3		21.7	23.3	24.3	20.2	22	

TABLE I. The upper part of the table shows the frequency distributions for each age level and the lower part, the scores at certain percentile points.

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